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AS

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/336,525	06/18/99	HUANG J	AMAT/3577/PD

IM22/0612

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EXAMINER	
PADGETT,M	
ART UNIT	**PAPER NUMBER**
1762	7

DATE MAILED: 06/12/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/336,525	Judy Huang
Examiner	**Group Art Unit**
M.L. Parly, H	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 3/5/01

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 24-45 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 24-45 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 6

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. Applicant's election of Group I, method claims 1-9 in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Furthermore, applicant has canaled all claims directed to Groups II and III, i.e. the apparatus and product claims, so their traversal is moot.

2. On page 7 of paper No. 5, in their remarks, applicants state that claims 34-45 are intended to be interpreted under 35 U.S.C. 112, the paragraph, and state that all amendments are supported by the specification, but cite no actual support.

In claim 34, in lines 2 and 6, "step for depositing..." meet the criteria for paragraph 6 interpretation, but in line 4, "step for treating..." does not, because it is modified by specific acts, i.e., "a plasma..... of inert gas to improve adhesion", that define this claimed step.

This specification was reviewed for the meaning under paragraph 6 of the claimed "step for depositing...", for the claimed first layer materials of "organic polymer materials, ∝C, ∝FC, SiC0H and SiC", and for a second layer deposited thereover. NO "step for depositing" language was found. NO deposition techniques for any materials of the first layer, except SiC (page 6, R.F. plasma with specific conditions and materials, clearly not applicable to all of the claim 34 Markush group) was found. NO specific organic deposition techniques for the second layer were found in the specification, although what the deposited materials might be were found on page 11 in Ex. 4 (but only for a first layer of SiC) and in the dual damascene discussions on page 12-15

(again only for SiC), where the discussion could be said to imply that CVD or plasma CVD process were used, especially where *in situ* processes were discussed, however applicants' summary (page 2) and other sections of the specification make it clear that *in situ* is only preferred, not required, so can NOT be said to define what range of disposition processes are included by applicant's paragraph 6 terminology.

As one of ordinary skill in the art would have no reason to confine depositions of organic polymer to the plasma CVD process used to deposit SiC, and as neither the claimed chemical formulas of ∝FC or SiCOH represent real compounds (see below rejection), there is no apparent difference in scope between the deposition steps of claims 24 and 34, i.e., any process of layer deposition will read on these claims. For this reason, dependent claims 35-36, 38-39, 42-43 and 45, have scopes defined by claim 34, but claim 37, which is limited to SiC has the first "step for depositing...." defined by the disclosure as limited to RF plasma CVD and its equivalents .

3. The attempt to incorporate subject matter into this application by reference to P.N. 5,000,113 to Wang et al on page 4 or to P.N. 4,951,601 to Maydan et al on page 15, is improper because incorporation by reference of a patent that already incorporates other patents, applications or references is not permitted, i.e., nested incorporations are improper. In Wang et al, see col. 8, and in Maydan et al, see col. 1 and 7. It is also noted that applicant's incorporated three applications 09/165,248 (page 5); 09/219,945 (page 6) and 09/193,920 {page 13) by reference, but these cases were not available for review, hence their propriety is unknown, however if any one of them incorporates other references, they also are improperly incorporated .

4. The disclosure is objected to because of the following informalities: proof reading is needed. On page 6, line 13 there is a sentence ending in a slash. The acronym "USG" is defined to be two different things on pages 9 and 13, while page 11 uses it in multiple ways, so that over all the intended meaning is confused in the specification.

Appropriate correction is required.

5. Claims 24, 26-27, 30-36, 38-39, 42-43 and 45 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification does not disclose any compound having the chemical formula "SiCOH" as in claims 24 and 34, but the summary (page 2) and page 5, line 22-24 list the chemical formula SiCO:H, which is different. The claimed formula requires are atoms of each of Si, C, O and H in the compound structure, while the disclosed formula indicates that SiCO is doped with hydrogen. Therefore, the claim contains New Matter.

6. Claims 24, 26-27, 30-36, 38-39, 42-43 and 45 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. To the best of the examiner's knowledge, there are no compounds having the claimed, and disclosed formulas of ∝FC or SiCOH (or SiCO:H), so deposition and treatment of these materials as claimed lacks enablement, unless applicant can

show their prior art existence and deposition. While the examiner notes that amorphous (∝) carbon that is fluorinated or doped with F is old and well known, that is NOT what applicant's either disclosed, nor claimed. Likewise, silicon oxycarbides that are hydrogen doped are known, but applicant's have claimed and disclosed a compound with a very specific formula.

7. Claims 27, 29-30, 39 and 41-42 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The independent claims already limit the plasma to "consisting essentially of any inert gas", therefore the limitation of these dependent claims 27, 29, 39 and 41 do not further limit the independent claim, as the substantial absence of O, N, H, as well as all other gases besides inert gas, has already been required. Similarly, claims 30 and 42, which introduce a generic gas, instead of the previously claimed inert gas, improperly broaden the scope of possible gases used.

8. Claims 24-45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims are not commensurate in scope with the preambles of the independent claims, because no semiconductor is required to be used either as the substrate, or in any step of the claim.

Since the claimed compounds of ∝FC or SiCOH are not known to exist, as discussed above, the intended meaning of these claimed materials can be considered unclear.

In claims 26, 28, 38 and 40, the relationship between "a He gas plasma" and "a plasma consisting totally of an inert gas" is somewhat confusing because the "comprises" of the dependent claims contradicts the "consisting essentially of" the independent claims. Phrasing such as -- the inert gas comprises He gas -- would be cleaner as not suggestive of gases other than inert, and appears to follow the intent.

In claims 30 and 42, lines 2 "a gas" does not refer to the gas already introduced in the independent claims, hence has an unclear relationship thereto, and potentially broadens the scope of the claims to other than the inert gases, therefor contradicting previous limitations.

In claims 33 and 45, "the composition" and "the same" lack proper antecedent basis, as does "the oxidation resistance" in claim 35.

Use of relative terms that lack clear meters and bounds in either the claims, specification or cited relevant prior art, are vague and indefinite. In claims 34, line 5 and claim 35, "improve" or "improves" compared to what? Under what conditions? For what purpose? etc... Claim 36 is more precise, but does the treatment prevent delamination under all conditions? The examiner notes that page 12 (Ex. 4) do not agree with the claim, as conditions where delamination occur after treating were given as greater than 7900 psi (very high but still existing)..

In claim 34, and its dependents as described above in section 2, the meaning of "step for depositing..." for either the first or second layers, is of unclear scope. As pointed out above, one

of ordinary skill would not find the act of depositing adequately defined by the specification to determine what range of deposition processes are necessarily defined or supported by the specification under paragraph 6, except in the incidence of SiC deposits

9. Claims 33 and 45 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no evidence or suggestion in the specification, that inert gas, plasma treatment of organic polymers, ∝-C, or "∝FC", or "SiCOH, or "SiCO:H" will have no composition changes caused by the plasma treatments. Figure 2, line A, described on page 6 provides support for these claims, only for SiC layers. A case could be made for amorphus carbon (∝C) with absolutely no impurities, having no change in chemical composition but applicants' specification provides no evidence for a like extrapolation to other claimed compounds, whose chemistry would not be the same (or is totally unknown as claimed), hence can not be said to be homologous.

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 24, 26, 27, 31, 33-36, 38-39, 43 and 45 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nguyen et al ('935).

Nguyen et al's technical field is for processing integrated substrates, including semiconductors (col. 1, lines 9-17), hence their entire process reads on the preamble claim of processing a semiconductor substrate. Part of Nguyen et al's process is coating all of the chamber with polymeric fluorocarbon, where these films exhibit predominately C-CF_x binding with a F/C ratio of about 1:1 to about 3:1 (col. 6, lines 44-53 and claims 10 and 16). While Nguyen et al does not discuss whether or not the polymers are amorphous in structure, such is a typical morphology for plasma polymerized deposits, hence maybe considered inherent, or alternately obvious due to their taught highly crosslinked and dense form. Note that as the range of F/C ratios includes the stoichiometry of applicants' claimed compound "∝FC", this rejection is made as a 102 as one of the closest possible meanings to applicants claimed/disclosed deposit and as having overlapping stoichiometry. For deposition on the chambers, the initial coating phase, see col. 3, lines 31; col. 4, line 4.

After precoating the chambers, electrodes and walls, the substrates are placed in the chamber and treated with a plasma of Ar, or alternately another inert gas, such as He (col. 2, lines 58; col. 3, line 9; and col. 4, lines 5-33). Then continuing processing in the same chamber,

another fluorocarbon film is plasma deposited, that will form on both the substrate and the chamber surfaces that were precoated, hence reading on the claimed sequence (col. 4, lines 34-col. 6, line 53 and Examples). Particularly note the teaching that the positive ion bombardment that takes place, creates films with high density that tend to resist taking up oxygen from air (col. 6, lines 28-30).

12. Claims 30-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al.

The parameters for the inert gas plasma cleaning process include RF power of 100-1000 watts, gas flow (Ar) of about 20-150 sccm, pressures of about 10-100 mtorr (.01-.1 torr) and a self bias of about -400 to -700 volts. While the flow rates overlap with applicant's claimed range, the pressure ranges just miss overlapping at about .1 torr and about 1 torr which is not a significant amount thus an obvious variation. Power and power density are not measuring the same quantities, hence power can not be compared by the PTO with the information given. It would have been obvious to one of ordinary skill in the art to determine power/power density relationships, and optimize them for particular reactor configurations, variations in gas pressure, etc., as well as for the particular materials being treated, plus desired effect of cleaning, but not reacting, thus like ranges of optimization for variations in apparatus, etc... would have been expected.

13. Claims 24-25, 27, 29 and 31-33 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Malaczynski et al.

14. Claims 26, 28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Malaczynski et al.

Malaczynski et al teach a process with multiple plasma steps, all taking place in one chamber with changes of gases used. A workpiece with an aluminum-silicon surface is treated in a plasma of carbon containing gas (methane and/or acetylene) to cause ion implantation of C to form a shallow layer that comprises silicon carbide as well as aluminum carbide and a by-product layer of graphitic material. Then the carbon containing gas is evacuated, and the vessel backfilled with argon gas or other suitable gases chemically inert to the workpiece. Plasma is formed and the Ar^+ or other inert gas ions sputter clean the graphitic material from the SiC containing layer. A fluid step involves plasma deposition of an amorphous DLC layer. See the abstract; col. 2, lines 13-44$^+$; col. 3, line 2-45, etc. Note that silicon is a semiconductor material and part of the substrate. The sixth paragraph claims (34$^+$) are not included, because the plasma deposition technique of Malaczynski et al which reacts plasma gas with the substrate via implanting to form the SiC, does not provide an equivalent process to applicant's plasma CVD process, where the SiC deposit is formed entirely from gaseous constituents.

Claims 26 and 28 differ by requiring He gas instead of Ar, however Malaczynski et al suggest use of other inert gases, therefore it would have been obvious to one of ordinary skill in the art to use helium, because it is essentially suggested, as it is homologous to Ar and would have been expected to effectively sputter clean.

While Malaczynski et al provide some parameters of watts, bias voltages, times (col. 2, lines 45-67) for their Ar plasma, they do not correspond to those parameters claimed by applicant of gas flow rate, pressure and power density, however all such parameter would have been employed in Malaczynski et al's plasma, hence it would have been obvious for one of ordinary skill in the art to determine non-disclosed parameters via routine experimentation, where values would have been expected to be analogous because no change in the SiC composition is contemplated in this case. Note that the graphic layers material is not considered by Malaczynski et al to be part of the carbide layer, so its composition may be considered unchanged.

15. Claims 24, 26, 27, 30, 33-36, 38-39, 42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al (935) in view of the German patent to Itoh et al.

While Nguyen et al is discussed above, this rejection is made considering the alternative, where the plasma treatment and deposition substrate(4), read on applicant's claims, instead of treatment of the chamber. In Nguyen et al, see the abstract; col. 1, lines 9-17; col. 2, lines 22-45 and col. 3, lines 18-47 for plasma deposition (i.e., plasma treatment) on a substrate that may be silicon containing or have an initially applied coating that may be silicon containing, including silicon oxides, where the substrate was *in situ* plasma cleaned (discussed in section 11). Gases such as C_2F_4, etc., may be input at a rate of about 20-150 sccm, with initial RF power densities being about 0.02 to 0.05 W/cm^2, with pressures during the initial plasma deposition of about 200 mtorr. While Nguyen et al's silicon containing substrate/multilayer are generically inclusive of

SiC or SiCOH layers claimed by applicant, their specific examples differ by not including these compounds/materials.

The German patent to Itoh et al, as discussed in the translation, on page, 2; page 3 (lines 1-8); page 5, 5-6th paragraphs; page 7, bottom; page 9, esp. last full paragraph; page 10, etc., teaches semiconductor devices having various layers, inclusive of an intermediate insulation layer containing Si, O, C and H, where the amount of C is not less than that of Si, via a CVD process, possibility a plasma process. This intermediate layer has formed on it another insulating film that is from a different material. Given these teachings, it would have been obvious to one of ordinary skill in the art, that the silicon containing surface that is Ar-plasma treated, than deposited with a fluorocarbon insulting layer in Nguyen et al, could have been effectively supplied by the intermediate layer of Itoh et al, because it fits all the necessary criteria of Nguyen et al, is a Si oxide derivative, and is desired to be used with a different insulative layer deposited on it.

16. Claims 24, 26-27, 33-34, 36, 38-39 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori.

In Mori, see the abstract, col. 1, line 5-25+; col. 4, lines 1-27 and 56-68; col. 5, lines 23-38; col. 6, lines 43-53; col. 11, lines 9-29; col. 12, lines 33-52; etc., for a process where a coating of an organic polymer or a SOG (spin-on-glass layer of Si oxide that may contain hydrocarbon residues), is treated with a plasma. Note, as seen on col. 11, lines 9-29 that the plasma may initially be only made from helium, hence reading on applicant's exposing step. Since the overall process may comprise any other number of steps besides those listed, it does not matter that the

plasma is followed by an inert gas plasma, as such is inclusive of the claim language. While Mori's process is implicitly for treating a layer in a semiconductor device that will be multilayered, they do not explicitly follow the plasma treatment steps with another coating, however it would have been obvious to one of ordinary skill that any of the dielectric or masking layers discussed by Mori are only one of a series of layers that would have been expected to be followed by subsequent layers, in all cases except the final capping layer.

17. Claims 24-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al (935) as discussed above in section 15, in view of Tanabe et al.

As noted above, Nguyen et al teaches generic silicon containing coatings, but not SiC used in semiconductor processing, however Tanabe et al (Abstract; col. 1, lines 5-18; col. 7, lines 30-36; col. 8, lines 56-65 and col. 10, lines 43- col. 11, lines 20+; and col. 12, lines 12-20) shows that use of SiC as an intermediate on semiconductor substrates, such as Si, where the SiC maybe deposited by various possible plasma CVD techniques, is known in the semiconductor art, with it further noted that diamond like deposits, unless doped are generally electrically insulating, hence it would have been obvious from teaching of Tanabe et al to use materials as SiC in the process of Nguyen et al for reasons analogous to those applied in section 15.

18. Also, of interest are Batha et al with further plasma CVD of SiC techniques, and Goel et al and Koike et al, who both teach use of SiC as an underlayer before DLC deposits, with teachings of inert gas plasmas cleaning before the claimed like coating, but are not discussing

semiconductor substrates, however would be cumulation to Tanabe et al above for motivating inert gas plasma used in the above combination.

19. Applicant's arguments with respect to claims 24-45 have been considered but are moot in view of the new ground(s) of rejection.

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CAR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CAR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M.L. Padgett whose telephone number is (703) 308-2336. The

examiner can normally be reached on Monday--Friday from about 8:00 a.m. to 4:30 p.m. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3599(official) and 305-6078(unofficial).

M.L. Padgett/dh

June 5, 2001

June 12, 2001

MARIANNE PADGETT
PRIMARY EXAMINER
GROUP 1700